DOCUMENT RESUME

ED 190 256 PS 011 635

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TITLE Experiential Determinants of Children's Food Preferences.
PUB DATE Nov 79
NOTE 37p.: Paper presented at the Conference on Children of the 80's (Urbana, IL, November 5-7, 1979).
AVAILABLE FROM To be published as a chapter in "Current Topics in Early Childhood Education". Vol. 3, 1980. Lilian Katz (ERIC Clearinghouse on Early Childhood Education), Editor. Ablex Publishing Corp., 355 Chestnut St., Norwood, NJ 07648 ($17.50).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Behavior Patterns: Child Rearing: *Children: Day Care: *Early Experience: *Food: *Individual Characteristics: Preschool Education
IDENTIFIERS *Context Effect: Food Consumption: *Food Preferences

ABSTRACT

This discussion focuses on elements of children's immediate experience that influence their food preferences. Some evidence suggests that there may be sensitive periods early in life that are critical for the formation of food preferences and aversions. Additionally, the familiarity and the sweetness of foods appear to be important determinants of children's food preferences. While studies of consumption patterns have frequently been used in making inferences about the food preferences of children, this practice is not appropriate because consumption patterns are determined by factors other than preference. Three elements of contact with food that potentially contribute to the formation of food preferences are the food, the person and the context. The need to maintain homeostasis, obesity, the sensory capacity of persons, and conditioned experience appear to be related to food preferences. Social-affective context influences the formation of food preferences in several ways. For example, exposing target children to peers who selected and ate the target children's nonpreferred foods was sufficient to change preference and consumption patterns of target children. Presenting foods as rewards and presenting them noncontingently paired with adult attention produced persistent and significant increases in the preferences of preschool children. Implications for child rearing practices in day care settings are indicated. (Author/RH)

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EXPERIENTIAL DETERMINANTS OF CHILDREN'S FOOD PREFFRENCES

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Food preferences are important determinants of young children's consumption patterns and nutritional status. This is particularly true in the higher income countries, where the ready availability of a large array of alternative foodstuffs provides opportunities for many food choices. From the broad set of diverse factors that appear to have an impact on the formation of children's food preferences, three categories of influence can be defined: (1) beliefs, attitudes, and knowledge about food imparted to the child by the culture, including food taboos and avoidances, prestige values of foods, and nutritional information; (2) physiological mechanisms, particularly the sensory systems of taste and olfaction, that give rise to sensations forming the basis of the child's perception of the organoleptic characteristics of foods, (3) factors arising from elements of the child's immediate and direct experiences with food. The discussion that follows is restricted to the third category of influence. Factors that are present in the child's direct and immediate experience with food and that are involved in the formation of food preferences include characteristics of the food itself, characteristics of the individual, and the social-affective context in which the experience with food occurs. In addition, the cumulative effects of the child's experience with food on the formation of food preferences will be discussed.

The Role of Early Experience in the Formation of Food and Taste Preferences

Early experience has been assumed to be particularly important in the formation of children's food preferences, and there is some evidence that there may be sensitive periods early in life that are critical for the formation of food preferences and aversions (Burghardt and Hess, 1966;

Garb and Stunkard, 1974). In addition, it has been suggested that food preferences established early in life persist throughout the life span, influencing preferences and consumption patterns during adulthood (Beauchamp and Maller, 1977; Greene, Desor, and Maller, 1975).

Garb and Stunkard (1974) reported that the onset of food aversions was greatest during early childhood. Based on this evidence, they suggested that there may be a critical period during childhood for the acquisition of food aversions. Their data were cross-sectional and based on the retrospective reports of approximately 700 individuals interviewed at different points in the life span, ranging from the preschool period through retirement. In order to find experimental evidence on the existence of critical periods in the formation of food preferences, it is necessary to look to work with organisms other than man. For example, Burghardt and Hess (1966) fed young snapping turtles one of three diets, then changed to a second diet for an equivalent period. The order of the diets was counterbalanced across groups. In a subsequent choice situation, 16 of the 20 animals showed a preference for the diet first experienced, indicating that the earlier experience was more important in the formation of food preferences than the later experience.

In reviewing the evidence on the role of early experience in the formation of food preferences in man, Beauchamp and Maller (1977) pointed out that in an early study by Davis (1929) on the consumption patterns of newly weaned infants, there was a perfect relationship between experience with fruit juice and preference for it by her sample of three children. However, Beauchamp and Maller also indicated that

the effects of early experience were confounded with frequency of exposure in Davis' research, and that an unequivocal answer to the question regarding the existence of sensitive periods awaits the results of experimental studies.

When Desor, Greene, and Maller (1975) compared the taste preferences of children and adults for sweet and salty solutions varying in concentration, the adults showed larger individual differences than the children in the concentrations of sugar they preferred, varying by as much as eightfold in preferred concentration. The authors interpreted these results as evidence for the importance of experience in the development of individual differences in taste preference. The role of experience in the formation of taste preference was explored further by Greene, Desor, and Maller (1975) who obtained preferences for several concentrations of sweet and salty solutions from both monozygotic and dizygotic twins. Because individual differences in preference existed and heritability estimates were low, they speculated that early experience was important in the development of preference, but did not entertain a critical period hypothesis. Taken together, the findings suggest that experience is important in the development of taste preferences. However, because all of these data are cross-sectional, cohort effects, maturational effects, and genetic differences among the cohorts, all of which are correlated with age, cannot be eliminated as possible explanations for the observed age-related differences. Although the results of research cited above suggest that critical or sensitive periods may exist during childhood in the formation of food preferences, research utilizing longitudinal, within-subjects designs that do not rely on retrospective report, is needed

in order to establish definitively the role of early experience in the formation of food preferences.

In a recent experiment employing a within-subjects design to investigate the effects of a short-term experience with food on food preference, Birch, (1979b) used a procedure developed to assess preschool children's preferences directly. Preference data for a set of fruits were obtained from 37 preschool children. In the direct assessment procedure, the child is presented with samples of all the foods in question and asked to taste each one and to place it in front of one of three faces, corresponding to the child's reaction to the food. One face was designed to depict someone who had just eaten something that tasted good, a second face depicted someone who had just eaten something that tasted bad. the third face had a neutral expression. After the child tasted each food and placed it in front of the face corresponding to his or her response to the food, the child then rank ordered the foods within each category. To accomplish this rank ordering, the child was asked to indicate the most preferred food in the set. As an item was designated by the child, it was removed from the set. This process was repeated until the foods in the set were rank ordered according to the child's preference.

The preference data were analyzed using multidimensional scaling procedures,

←Based on information obtained from food histories completed by the children's parents and from the children's ability to name the foods correctly (e.g., all the children named bananas correctly, but only 7 of 37 could supply the correct name for dates), the first dimension of food preference was labelled familiarity.

It is the first dimension because it accounts for the largest percentage of the variance in the data (29%). The second dimension, accounting for an additional 26% of the variance, was labelled sweetness. When the data from three subsequent preference assessments of the same children, obtained over a period of approximately six months, were analyzed, the same two dimensions consistently emerged.

Familiarity is, of course, a function of experience and exposure, and its consistent emergence as a salient dimension underlying preference attests to the importance of experience in the establishment of children's food preferences. Zajonc (1968) stated a general hypothesis relating the effects of experimental exposure to preference in the following way: "Mere repeated exposure of the individual to a stimulus is a sufficient condition for the enhancement of [the individual's] attitude toward it." Presumably, "mere repeated exposure" leads to increased familiarity and produces increased preference. The mere exposure hypothesis has received support from research with adult subjects using a variety of stimuli, including Chinese characters (Zajonc, 1965), paintings (Maslow, 1937), and human faces (Zajonc, 1968); a study by Kail (1974) with school age children using visual stimuli similar to those used by Zajonc (1968) also produced results consistent with the exposure hypothesis. However, there is only one study in the literature that investigated the effects of exposure on preference using foods as stimuli. In that study, Peryam (1963) presented novel foods to American soldiers four times at monthly intervals. Preference for the foods was initially low and no positive shift in preference was noted with repeated exposure. The failure to note an exposure effect may have been due to the low levels of exposure his subjects received.

In the Birch (1979b) study, an initially unfamiliar food, dates, was repeatedly presented to the children. Dates were selected based on the results of the multidimensional scaling analysis,

food history data, and the children's ability to name the foods. If mere repeated exposure increases

familiarity, then the location of dates on the familiarity dimension was expected to shift toward the familiar pole of the dimension when preferences were reassessed following repeated exposure. A comparison of the preference orders from the pre- and post-exposure assessments would indicate whether this increased experience with the food increased preference.

The children were exposed to dates each day for seven consecutive days of the preschool program. The food was presented in the context of the lunch program, and the children received the initially unfamiliar item in addition to the other foods on the menu. The resulting preference data indicated that

At the end of the experimental period, dates were ranked as more familiar than before, consonant with the expected direction of change. However, although familiarity was increased, no positive shift in preference occurred as a function of the additional exposure.

A closer look at the data from the ten children who initially ranked dates last in their preference order provides some information on the failure to note consistent support for the exposure hypothesis. Half of these ten children showed increased preference, and all of them were 3-year-olds. Two of these children indicated that dates were now their favorite fruit, and the other three children ranked dates in the middle of their preference order. The food histories of these five

children indicated that for four of them, dates had never been served at home and were unfamiliar. Results of the multidimensional scaling analysis indicated that familiarity was weighted heavily by these 3-year-olds. In contrast, the other five children showed no change in preference. All of them were 4-year-olds. The food histories of these children indicated that dates had been served to all of these children at home and were, therefore, familiar to the children at the beginning of the exposure procedure. Food histories also indicated that four of these five children consistently refused dates when they were served. Results of the multidimensional scaling analysis showed that sweetness was more heavily weighted by these children than familiarity and that they tended to prefer the more sour fruits, such as grapefruit and pineapple, to the sweeter ones. The information indicating that a change in preference occurred in children for whom dates were initially unfamiliar is consistent with the generalization that the exposure effect is noted only when stimuli are unfamiliar initially (Zajonc, 1968). When the total sample was divided into 3- and 4-year-old groups, and the data for the two groups analyzed separately, familiarity was found to be the first dimension for the 3-year-olds, and sweetness the first dimension for the 4-year-olds, reflecting the age difference in the salience of the two dimensions noted for the subsample of ten children.

The importance of familiarity as the major dimension of preference for the youngest children suggests that early exposure and experience with foods is very important in the formation of food preferences. Children tended to like the familiar and dislike the unfamiliar foods. The relatively rapid shift from familiarity to sweetness as the

primary dimension underlying preference from 3- to 4-years is consistent with the data cited previously suggesting the existence of sensitive periods in the formation of food preferences, with items that are exposed during the period while familiarity is particularly salient tending to become preferred.

Notwithstanding the preceding discussion of the effects of "mere repeated exposure," experience does not take place in a vacuum, and the context in which exposure occurs can be expected to make important contributions to the formation of food preferences. Because of the importance of these context effects, they will be discussed as a separate topic in a later section of this paper.

In contrast to research suggesting that experience plays an important role in the formation of preferences for foods, there are data indicating that experience does not figure centrally in the formation of preferences for the four basic tastes (sweet, sour, salty, and bitter). For example, when Desor, Maller, and Turner (1973) studied the responses of newborns to plain and sweetened water, the neonates indicated a preference for sweet solutions over plain water and increased their consumption of the sugar solutions at higher concentrations. When they compared the responses of the neonates to those of older infants (5 to 11 weeks and 20 to 28 weeks) using the same preparations, all groups showed the same relative pattern of consumption: more of the sugar solutions than of the water was consumed and consumption increased at higher sugar concentrations. Desor, Maller, and Greene (1977) also reported a comparison of the infant data cited above with adult data obtained by Stellar (1967) and noted that the two sets of results were strikingly similar. They concluded

that, despite the extensive dietary experience adults have had, they continue to exhibit the same ingestive responses to sweet that they had at birth and that experience contributes little to the etiology of the taste preference for sweet.

With respect to the question of whether early preferences and aversions persist throughout life, the only evidence available from human subjects appears in the retrospective reports of Garb and Stunkard (1974). People frequently reported that food aversions formed in childhood persisted into adulthood, some for as long as fifty years. The authors did not attempt to determine whether foods that were preferred early in life were still preferred in adulthood. However, there is some evidence from nonhuman species suggesting that early preferences persist later in life. For example, Capretta and Rawls (1974) demonstrated that rats who were exposed to a garlic flavor during nursing and after weaning showed a greater preference for the flavor than did controls later in life. Although the retrospective data of Garb and Stunkard (1974) suggest that preferences may persist throughout life, longitudinal data are needed in order to trace the course of food preferences through the life span.

Descriptive Studies of Children's Food Preferences and Consumption Patterns

During the past 50 years, there have been numerous descriptive studies of children's consumption patterns and food preferences. Studies of consumption patterns are cited in this discussion because consumption data have frequently formed the basis for inferences regarding preferences. In some cases, consumption data were obtained through direct observation (Davis, 1928; Dunshee, 1932; Harrill, Smith, and Gangever, 1972; Lamb and Ling, 1946), and in others, maternal reports of children's consumption have

formed the basis of inferences about children's food preferences (Bryan and Lowenberg, 1958; Dierks and Morse, 1965; Eppright, Fox, Fryer, Lamkin, Vivian, and Fuller, 1972; McCarthy, 1935; Sanjur and Scoma, 1971).

When consumption measures are used as the basis of statements regarding food preferences, the implicit assumption made is that the more an individual eats of something, the more highly preferred that something is. This assumption can be criticized on the grounds that factors other than preference affect consumption patterns. For example, foods differ in satiety value; the fact that an individual consumes more lettuce than chocolate fudge does not necessarily indicate that lettuce is preferred to chocolate fudge. Furthermore, when data are obtained by presenting foods on different days, and relative consumption of those foods is used as a measure of preference, the observed differences in consumption may be a function of day-to-day differences in the physiological state of the individual, rather than reflecting differences in food preference.

Investigators have relied rather heavily on maternal report in obtaining information on children's consumption patterns and preferences. Their rationale for the use of maternal report has been that children are unreliable sources of information and cannot provide data regarding their own food preferences (Bryan and Lowenberg, 1958). Unfortunately, mothers are also unreliable sources of data regarding their children's behavior, and with respect to food preferences, Glaser (1964) noted considerable variation in the parents' and the children's reports of the children's food preferences. For example, although parents stated that 31 percent of their children disliked broccoli, only 10 percent of the children indicated a dislike for broccoli. Further evidence on the

inaccuracy of maternal report comes from a study by Birch (in press) in which maternal reports of children's preferences were compared and correlated with children's preferences obtained using the direct assessment procedure described earlier. Based on 76 mother-child pairs, the median correlation (tau) between these two measures of children's food preferences was only .29 (the tau value corresponding to the $p<.05$ level of significance is .60), and the correlations were significant in only 20 percent of the mother-child pairs. Furthermore, observations made in our laboratory fail to confirm Bryan and Lowenberg's contention that children cannot provide reliable information regarding their own preferences; children as young as 2½ years do not hesitate to communicate their likes and dislikes about foods presented to them, and the data obtained using the direct assessment procedure have demonstrated that the preference data are reliable (Birch, 1979b) and valid predictors of consumption (Birch, 1979c).

Because consumption patterns are determined by factors other than preference (e.g., satiety value, availability, physiological state of the individual, cost, caloric content), it is not appropriate to use consumption measures as the basis of inferences regarding food preference. However, because preference is an important determinant of consumption patterns, knowledge about food preference should be useful in predicting consumption patterns. Birch (1979c) established that preference data were effective predictors of children's consumption in a self-selection setting. Independent measures of preschoolers' preferences and consumption patterns were obtained during snack periods for four consecutive days.

Snacks were eight different kinds of small, open-faced sandwiches with different types of spreads. Preference assessment procedures were the same as those described previously. To obtain the consumption data, four groups of four preschoolers participated in a "special snack" period each day for four consecutive days. An array of serving plates, each with a different type of sandwich on it, was presented to the children, who were given small plates and told that they could take the sandwiches they wanted to eat and that they could return for more if they liked. An observer recorded each child's consumption. The order of preference assessment and consumption was counterbalanced over days. The obtained correlation between the measures of preference and consumption was .80 for the total sample, higher than correlations of preference and consumption reported by Pilgrim (1961) for adult subjects that ranged from .50 to .70. It is possible to speculate that the relationship between preference and consumption is stronger for children than for adults because cultural factors that come to play an influential role in the food choices of adults (e.g., nutritive value, caloric content, cost, prestige value) have not yet become relevant for young children, whose preferences and consumption patterns are primarily a function of input from their direct erience with foods.

An example of a carefully conducted study of consumption patterns in very early childhood is the early work of Davis (1928), whose results are widely quoted and frequently misinterpreted. She observed the consumption patterns of three newly weaned infants in a setting where they were allowed to self-select their diets. She did not draw inferences regarding preferences. The infants were presented with a large variety

of foods, simply prepared, with no added seasonings or salt. Salt was available at mealtime for seasoning but sugar was not. The foods offered included selections from the following categories: muscle meats, organ meats, seafoods, cereals, bone products, eggs, milk, fruits, and vegetables. Davis concluded that, given this set of alternatives, the infants were able to select a nutritionally adequate diet. This work is frequently cited as evidence that children can select a nutritious diet from among the alternatives available to them. The fallacy of the interpretation has been pointed out by Gussow (1972): given the set of alternatives available to the children in the study, it would have been difficult for them to select a diet that was inadequate. The experimental situation bears little resemblance to the alternatives typically presented to children in our contemporary society, who are frequently presented with arrays of highly sugared and processed foods and who are the targets of media campaigns designed to sell highly sugared cereals, soft drinks, snack foods, and candy.

Contributions to the Formation of Food Preferences in the Young Child: Intrinsic Dimensions of Foods, Characteristics of the Individual, and Context

Young (1968) has maintained that, in man, the pleasantness or unpleasantness of contact with food determines acceptance, rejection, and preference. Aspects of three elements of the contact situation can potentially contribute to the formation of food preferences: the food, the person, and the context.

Intrinsic dimensions of foods. Foods are very complex, multidimensional stimuli. Despite the numerous descriptive studies of children's consumption

patterns and preferences, very little is known about the relative salience for young children of the dimensions of food : e.g., texture, temperature, aspects of taste and aroma, and visual characteristics. Are some of these dimensions more important than others in determining preferences? Are there individual differences and/or age differences in the relative contributions of these dimensions to preferences?

A major objective of the study by Birch (1979b), discussed above, was to begin to obtain information on these questions. The method used in this research to assess children's preferences has already been described. Two dimensions consistently emerged throughout a series of four assessments: familiarity and sweetness. Although other dimensions in addition to these may have been used by the children in making preference judgments, these two dimensions consistently accounted for approximately 60 percent of the variance in the preference data. The implications of the existence of a familiarity dimension were discussed in a previous section of this paper. The emergence of a sweetness dimension is not surprising in light of the data indicating that the preference for the sweet taste is innate and changes little with experience (Desor, Maller, and Greene, 1977). Results of other studies (Birch, 1979a, 1979c) have also shown sweetness to be a salient dimension in preschool children's preference judgments for foods in addition to fruits, including sandwiches and snack foods.

Physiological characteristics and bodily states of the individual. The effects of disruption of homeostasis on taste preference have been studied in adult humans and in other organisms, but there is no evidence regarding the effects of deprivation and satiation states on

children's preferences for foods. Grinker (1977) did report that no difference was found in children's taste preferences for simple sucrose solutions when the solutions were tasted before and after lunch. These findings are consistent with the results of work by Moskowitz, Kumaraiah, Sharma, Jacobs, and Sharma (1975), who reported no differences in the pleasantness ratings for citric acid and quinine sulfate solutions when they were tasted before breakfast and after lunch. In contrast, Cabanac (1974) and Moskowitz, Kumaraiah, Sharma, Jacobs, and Sharma (1976) noted that after a satiating glucose load, adults' taste and aroma preferences shifted from liking toward disliking, and Cabanac has maintained that pleasure serves the physiological function of helping to maintain homeostasis. The conflicting results noted in the two sets of studies may be due to differences in procedures used to manipulate metabolic state. In the research reporting differences in preference as a function of metabolic state, satiety was defined by ingestion of a glucose load. In contrast, in studies providing no support for differences in preference as a function of metabolic state, satiation was defined as "after lunch." The view that homeostatic needs affect palatability of foods and preference for them agrees with common sense; water "tastes better" when you are thirsty than when you are not; a steak "tastes better" when you are hungry than after a large meal (Young, 1977). Despite intuitive appeal, generalizations from results of research on the effects of physiological state on taste preferences to their effects on food preferences must be made with caution.

Obesity, a more stable characteristic of the individual, has been shown to be related to preference. Obese adults show different preference

functions for sweet than do normals (Grinker and Hirsch, 1972). While normal weight adults tend to show increasing preference for increasing concentrations of sugar solutions until a breakpoint in preference is reached, obese individuals found the same series of increasing sucrose concentrations increasingly unpleasant. Grinker (1977) reported that when taste preference data were obtained from normal weight and obese school age children from 8- to 10-years-old, the obese children showed preference functions remarkably similar to those described for obese adults: the more concentrated the solution, the less frequently it was preferred. The normal children performed more like the normal adults, preferring the more concentrated solutions over less concentrated ones.

The sensory capacity of the individual can be expected to influence taste and food preferences. It has been reported that humans have a wider distribution and greater number of taste buds during infancy and early childhood than at any time later in life (Arey, Tremaine, and Monzingo, 1935), and there is reason to believe that the form of the functions relating the concentration of preparations to perceived intensity and preference may change with development. Although there has been speculation on this point, very little evidence exists. Feeney, Dodds, and Lowenberg (1966) explored age differences in sensory thresholds using preschool children and their parents as subjects. Parents and children were presented with distilled water and asked to compare it with low concentration sucrose solutions and to indicate when the two solutions tasted differently. These data were used to determine sensory thresholds for the two age groups. No age differences were noted; children and their parents showed equivalent sensitivity in discriminating between distilled water and the sucrose solutions. However, the absence of age differences in thresholds

does not provide information on whether the forms of the functions relating concentration to perceived intensity and preference differ with age.

In a study discussed previously, Desor, Greene, and Maller (1975), compared the taste preferences of children and adults and indicated that children tended to prefer higher concentrations of sugar solutions than did adult subjects. If children are more sensitive than adults, then this age difference is not in the predicted direction unless the form of the function relating perceived intensity and preference is very different for the two age groups. Unfortunately, data on the perceived intensity of the solutions were not reported, so it is not possible to determine whether the differences in preference are mediated by differences in perceived intensity.

There has been a good deal of research on the taste sensitivity of neonates. Investigators have noted, for example, that sweet is discriminated from nonsweet at birth (Desor, Maller, and Turner, 1973; Engen, Lipsitt, and Peck, 1974; Nisbitt and Gurwitz, 1970), and, as previously noted, that newborns will ingest increasing amounts of sweet solutions at increasing concentrations. These data, which suggest that the preference for sweet is present at birth, are consistent with LeMagnin's (1977) statement that the sweet taste acts as an unconditioned stimulus for eating and drinking in many species, apparently including humans.

Probably the most extensive literature on the influence of the physiological state of the organism on preference is that on conditioned aversions. It has been shown repeatedly that an initially preferred food can be made aversive after only a single association with illness which

follows ingestion (Garcia, Kimeldorf, and Koelling, 1955; Garcia, Hankins, and Rusinak, 1974). In a related phenomenon, positive shifts in preference are noted in cases where ingestion of a foodstuff is followed by positive effects such as recovery from thiamine deficiency (Garcia, Ervin, Yorke, and Koelling, 1967; Rozin, 1965). Although the research elucidating the nature of conditioned aversions and the mechanisms involved in their acquisition has employed nonhuman species, Garb and Stunkard's (1974) work showed that conditioned aversions frequently occur in humans as well.

The laws of learning apply to the formation of affective processes and preference (Young, 1968), and Garcia, et al. (1974) pointed out that it is possible to operationally describe the acquisition of taste aversions in classical conditioning terms. However, they also point out that in the case of conditioned aversions (and perhaps in the acquisition of preferences), the animal does not appear to have acquired an if-then relationship which describes what is generally learned in classical conditioning, e.g., "if bell, then food," but rather a change in the preference for the food occurs. A bit of introspection suggests that this is also the case in humans. For example, if you had once become ill after eating chocolate ice cream, your subsequent response to chocolate ice cream would probably not be, "If I eat this ice cream, (then) I'll get sick," but rather one of revulsion and nausea reflecting your aversion and leading to the rejection of chocolate ice cream. As a result of the pairing of the food with illness, a negative shift in preference has occurred rather than the acquisition of a new contingency relationship.

Context. Within the limits set by innate taste preferences and characteristics of the individual on the range of food preference,

the social-affective context in which foods are presented influences the acquisition of food preferences. Context functions in a number of ways to influence the formation of food preferences. Children's preferences are influenced by the food choices and eating behaviors of others present (Birch, 1980; Duncker, 1938; Marenho, 1942; Harper and Sanders, 1975), by the behavioral consequences of eating (Ireton and Guthrie, 1972), and by the social affective context in which foods are presented (Birch, 1979a; Birch, Zimmerman, and Hind, in press). Although a discussion of the effects of television advertising on children is beyond the scope of this paper, concern with the effects of television advertising on the acquisition and modification of children's food preferences has been voiced recently in hearings held by the Federal Trade Commission on the topic of television advertising directed at children, and there is evidence that such advertising does influence children's food preferences as well as the purchasing patterns of parents (Galst and White, 1976; Goldberg, Gorn and Gibson, 1978; Reiss, 1977).

Harper and Sanders (1975) investigated young children's willingness to sample novel food when mothers and strangers modeled the eating of the food. The mothers were more influential than the strangers, although modeling produced effects on the children's eating behavior in both cases. Younger children were more affected by the procedures than were older children. Results also indicated that children were more likely to eat a novel food if the adult modeled eating than if the adult merely offered food to the child. No preference data were obtained from the children so it is not possible to ascertain whether modeling also produced increased preference for the foods.

In a study of social influence on children's food preferences, Duncker (1938) employed two different social contexts in an attempt to modify preschool children's food preferences, including the use of a story in which the hero showed a strong preference for a bad tasting food over one with a more pleasant taste. As a result, the children's preferences showed a temporary shift to the food preferred by the story's hero. The second procedure involved exposing children to other children with different preferences. After observing other children choosing foods to eat, each child was asked about his or her own preferences in the presence of the other children. When these preferences were compared to those obtained from the children prior to social influence, results indicated that the children who were exposed to others' choices showed a high percentage of choices of the peers' preferred foods. Age differences in the effects of social influence appeared; when the child who was the object of influence was younger than the others, more change in preference was noted than when the child was older than the peer model. Duncker did not obtain adequate data on the children's preference in the absence of other children in order to determine whether the children's choices were a function of conformity or whether the changed choices reflected a shift in preference. Marenho (1942), in a subsequent study of the effects of social influence on food preference, noted that success in modifying the children's preferences was a function of how well established the initial preference was and that modification of preference occurred more readily in younger children, who presumably have less well-established preferences.

In an attempt to modify existing food preferences, Birch (1980) investigated in a natural setting, the influence of peer models' food selections and eating behaviors on preschoolers' (3- and 4-year-olds) food preferences and food choices and eating behaviors during lunch. Based on assessed preferences for vegetables, a "target" child who preferred vegetable "A" to vegetable "B" was seated at lunch with three or four peers with the opposite preference pattern. The children were then presented with their preferred and nonpreferred vegetable pairs and asked to choose one. Choices were made in a specified order. On the first day, the target child chose first, while on days 2, 3, and 4 of the procedures the peers made their selections first. Seventeen situations of this type were arranged. The target children showed a significant shift from choosing their preferred vegetable on day 1 to choosing their nonpreferred vegetable on day 4. When the target children's preferences were reassessed at intervals up to several weeks following the conclusion of the luncheon procedures, the target children still showed a significant positive shift in preference for their initially nonpreferred vegetable. Because this later preference assessment was performed in the absence of peers, conformity cannot account for the shift in preference. Consumption data also indicated a significant increase in the amount of the nonpreferred food that the target children consumed over days. Thus, exposing children to peers with different preferences who selected and ate the target children's nonpreferred foods was sufficient to change both preference and consumption patterns. Age differences also appeared in the data, with more younger children than older children showing positive preference shifts. These results indicate that modeling appears to have both immediate and more lasting effects on food

preferences. The consistent emergence of age differences in the effects of modeling on food preferences noted in the studies presented above is again suggestive of the existence of a sensitive period during the early preschool years for the formation of food preferences.

The success of the social influence procedures in producing changes in food preferences suggests that if children were routinely exposed to other children with food preferences differing from their own, they would begin to broaden the set of foods acceptable to them. This is particularly important in light of the findings of Eppright et al. (1972), who reported that one of the central concerns of the mothers they interviewed was the limited number of foods their preschool children would accept.

Ireton and Guthrie (1972) looked at the effects of operant conditioning procedures on children's consumption patterns. In an attempt to increase vegetable consumption, the children were given tokens and verbal reinforcement contingent upon their consumption of premeasured servings of vegetables. Results indicated that this procedure produced significant increases in consumption but no data are reported to indicate whether positive shifts in preference for the vegetables may also have occurred as a result of the operant conditioning procedures.

Recent work by Birch (1979a) and Birch, Zimmerman, and Hind (in press) indicates that positive shifts in preference can be obtained by manipulating the social-affective context in which foods are presented. Participants in this study were 3- to 5-year-old preschoolers whose preferences for a set of eight snack foods were assessed at the beginning of the experiment. Based on these assessed preferences, a "neutral" food was selected / for presentation to each child in one of four contexts: as a reward;

noncontingently, paired with adult attention; in a nonsocial context; or at snacktime, in addition to the other seven snack foods. Presentations were made twice per day on 21 days over a period of six four-day preschool program weeks; 16 children participated in each condition. Preferences were reassessed during the presentation procedures at four and six weeks (following 30 and 42 presentations), and again six weeks after the conclusion of the procedures. The results of this research are presented in Figure 1. It is clear that the social-affective

[Insert Figure 1 about here]

context in which foods are presented influences food preferences. Both presenting foods as rewards and presenting them noncontingently paired with adult attention produced significant increases in preference. The effects were not transitory, but persisted for at least six weeks after the termination of the procedure. Familiarity cannot account for the effects because in each condition, the other foods in the set were presented to the child at snacktime on each day of the classroom presentation procedures, ensuring approximately equivalent exposure to all the snack foods. Half of the children in each presentation condition received a sweet food and half a nonsweet food. No differences in the effects of context were noted as a function of whether the presented food was sweet or nonsweet.

It is common practice for adults in many cultures to use sweet foods as rewards to control children's behavior or as treats or pacifiers; sweet foods are also consistently presented in other positive contexts, including holiday celebrations and parties. Evidence on the pervasiveness of these practices in the United States comes from the work of Eppright et al. (1972), who interviewed 2000 mothers of preschool children in the North Central region of the United States regarding their food habits

and nutritional practices. Sixty-two percent of the sample indicated that they used sweet foods as rewards, treats, pacifiers, or that they withheld sweets as punishment (in the same interview, 21 percent of the mothers were concerned that their children were consuming too many sweets).

The results of the research by Birch (1979a) and Birch, Zimmerman, and Hind (in press) have shown that the practices reported by the mothers in the Eppright et al. (1971) research, including presenting foods as rewards or treats in positive contexts, produce enhanced preferences for those foods, and the findings take on particular importance in light of current concern with per capita consumption of refined and processed sugar that is reflected in the revised Dietary Goals for the United States (1977): consumption of refined and processed sugars should be reduced by nearly half (45 percent). One way to help curb our "sweet tooth" would be to make individuals who interact with young children aware that using sweet foods in positive contexts enhances preference for those foods, and to urge the use of alternative practices. The results have also demonstrated that positive social-affective contexts can increase preferences for nonsweet foods as well. This suggests that positive contexts could be used to produce positive shifts in preference for foods relatively low in refined and processed sugar and therefore more desirable from a nutritional standpoint.

Conclusions and Implications

1. It is clear that early life experiences influence the formation of food preferences in the young child. However, evidence consistent with the assumption that the effects of early experience persist throughout the life span is lacking, and longitudinal data are needed to resolve this issue.

2. Our knowledge regarding how developmental changes in the sensory systems of taste and olfaction might influence the development of food perception and preference is extremely limited. In contrast to the simple solutions typically used in studies of taste preference, foods are complex, multi imensional stimuli. Generalizations to food preferences from work on taste preferences must be made with caution.

3. Despite many normative-descriptive studies of children's consumption patterns and food preferences, our understanding of the relative salience of the many intrinsic dimensions of food in determining food preference is far from complete.

4. Although innate taste preferences and cultural factors appear to set limits on the range of food preference, transitory and relatively stable states of the individual, the context in which foods are presented, and dimensions of the foods can influence the formation of food preferences.

5. Learning and experience are very important in the formation and modification of food preferences,and evidence from several diverse sources suggests that early childhood may be a particularly sensitive period in the formation of food preferences and aversions. Additional data obtained from human subjects are necessary to resolve this point.

6. Whether or not the data provide support for the existence of sensitive periods during early childhood, it is clear that young children's food preferences are very malleable. Research has demonstrated that children's food preferences are modified by exposure to peer models who have different preferences, and by the social-affective context in which foods are presented. These findings have implications for child rearing

practices. The range of foods acceptable to children could be expanded by systematically exposing children to others with different preferences, and day-care settings should be particularly amenable to such efforts. It should also be possible to minimize the enhancement of the preference for sweet foods by avoiding practices involving the presentation of sweet foods in positive contexts. Positive social-affective contexts could also be used to enhance preference for foods lower in sugar content and higher in nutritional value that are not initially highly preferred by young children.

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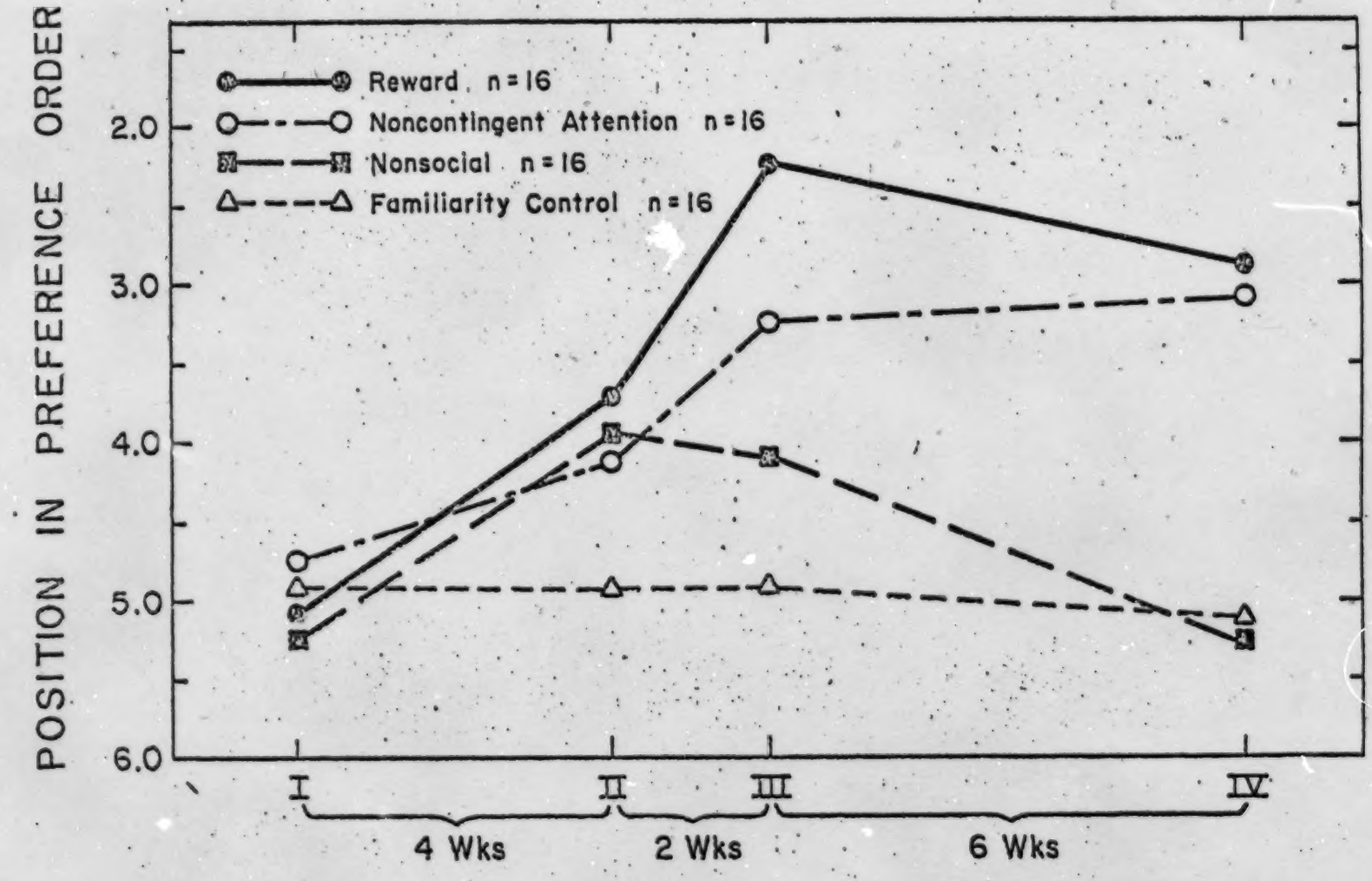
POSITION IN PREFERENCE ORDER
2.0
3.0
4.0
5.0
6.0
Reward n=16
Noncontingent Attention n=16
Nonsocial n=16
Familiarity Control n=16
I
II
III
IV
4 Wks
2 Wks
6 Wks
ASSESSMENT

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